Media Notes
for North Carolina Growers

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Chemical Characteristics of Pine Bark

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The chemical properties of pine bark media differ from those of mineral soils. These differences influence the amount of lime and fertilizer required for optimum growth. There are several reasons for their differences in optimal pH and nutrient-holding capabilities.

The pH of native pine bark is generally 4.5 or lower (Table 1). The pH of mineral soils ranges from 5.0 to 6.0, depending on past production history. Although the optimum pH for mineral soils ranges from 5.5 to 6.0, nursery crops grow quite well in pine bark media with a pH of 5.0 to 5.5. The difference in optimum pH of the two media is due to the toxic effect of aluminum in mineral soils, whereas pine bark substrates generally contain little or no aluminum.

Pine bark media and mineral soils differ in their nutrient-holding capability because of differences in their chemical makeup. Nutrient retention sites in pine bark are associated with the organic fractions (R-COO-H). These sites hold positively charged ions such as calcium, magnesium and potassium quite well. However, the organic fraction repels negatively charged phosphate ions ($H_2PO_4^-$ and HPO_4^{-2}) causing them to be lost from the media by leaching. Research has shown that phosphorus leaches quite readily from pine bark substrate.

Leaching of phosphate from pine bark media poses several problems. Optimum growth is hindered; fertilizer costs increase; and phosphorus runs off into surface waters, posing a threat to the environment.

In contrast, nutrients in mineral soils are held by negatively charged nutrient retention sites that originate from the clay fraction. Clays also contain iron and aluminum oxides, which have a strong affinity for the negatively charged phosphate ions. Reaction of phosphate with iron and aluminum removes it from the soil solution, which prevents it from leaching. However, phosphorus retained by the oxides is still readily available for plant uptake.

When dolomitic lime is applied to acid organic substrates, hydrogen (H+) is displaced from the organic functional groups (R-COO-H) and replaced with calcium and magnesium. When organic acids (H+) are neutralized, plants benefit from increased pH, calcium and magnesium. Lime also enhances microbial activity within the media.

Although adding mineral soil to bark media is not a widely accepted practice in the nursery industry, it provides an effective means of reducing phosphorus leaching without any adverse effect on plant growth. The amount of mineral soil required to hold phosphorus is quite small relative to the other media components. To overcome concerns about drainage, use a sandy loam soil. These soils are generally well drained and are composed of sand particles coated with clay. The clay coating provides reactive sites required for retention of phosphorus. The chemical characteristics of native pine bark are shown in Table 1. These data were generated from analysis of pine bark samples over several years from individual growers and commercial bark suppliers.

Table 1. Chemical characteristics of native bark before amendment.

Soil Test Parameter	*Ranges*
Bark pH	3.4 - 4.5
Acidity (Ac)	4.4 - 7.4
Phosphorus (ppm)	11.5 - 23
Potassium (ppm)	134 - 215
Calcium (% of CEC)	8.50 - 24.0
Magnesium (% of CEC)	4.50 - 6.20
Manganese (ppm)	4.5 - 15.0
Zinc (ppm)	1.80 - 4.40
Copper (ppm)	0.22 - 0.50
Cation Exchange Capacity (CEC)	6.30 - 9.92